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OCCUPATIONAL SAFETY AND HEALTH STANDARDS BOARD

BOARD STAFF'S REVIEW OF PETITION FILE NO. 533

Petitioner: Rob Frashefski, North American Sales Manager
MineARC Systems America LLC

M. Chan

Submitted by: Maryrose Chan
Title: Senior Engineer-Standards
Date: May 20, 2013

INTRODUCTION

The Occupational Safety and Health Standards Board (Board) received a petition dated March 19, 2013 from Mr. Rob Frashefski, North America Sales Manager of MineARC Sytems America LLC. MineARC Systems is a worldwide company that manufactures and supplies emergency safe-refuges to the underground mining, tunneling, and chemical processing industries.

Labor Code Section 142.2 permits interested persons to propose new or revised regulations concerning occupational safety and health and requires the Board to consider such proposals and to render its decision no later than six months following their receipt. In accordance to board policy, the purpose of this evaluation is to provide the Board with relevant information upon which to base a reasonable decision.

The Petitioner seeks clarification regarding the requirement to provide a refuge chamber if there is no alternate escape route in a tunnel that is classified as gassy or extra hazardous. Petitioner contends that the current standard does not list technical specifications regarding design, structural and breathable air requirements for a refuge chamber.

Furthermore, the petitioner recommends that refuge chambers with the following specifications be provided in ALL tunnel types where a secondary escape route is not available:

1. Occupancy- refuge chambers sized according to the maximum number of crews and visitors.

2. Entrapment Duration-employees and visitors must have the means to survive in a chamber for 36 hours with no assistance from external compressed air supply or main power supply.

3. Primary Life Support-compressed air system capable of providing minimum 3 cubic feet per minute (CFM) per occupant, with means of regulating flow and isolating systems during emergencies. Systems should include filter or other means of ensuring air quality with the ability to remove moisture (condensation) prior to introduction into the refuge.

4. Positive Pressure-include automatic means to ensure that internal pressure is relieved at maximum 0.18 psi.

5. Secondary Life Support-include secondary breathing air cache in the form of medical grade or aviator style oxygen cylinder. The cache is to be sized accordingly to provide minimum 0.02 cubic feet of oxygen per minute, per occupant, for the intended duration of refuge (36 hours). Delivery should be capable of being regulated consistently to maintain oxygen concentrations between 18.5% to 23%.

6. Carbon Dioxide Removal-equipped with carbon dioxide removal systems removing no less that 0.85 cubic feet of carbon dioxide per hour per occupant for intended duration (36

hours). The system must be able to maintain concentration at 1% or less within the chamber at all time.

7. Carbon Monoxide Removal-equipped with carbon monoxide removal system capable of maintaining carbon monoxide below the long term exposure limit of 30 ppm within the chamber for intended duration (36 hours).

8. Cooling & Dehumidifying-include a cooling/dehumidifying system with minimum capacity of 400 BTU/occupant, for removal of moisture (humidity) and reduction of heat sources within the chamber (i.e: metabolic heat, electrical equipment, air scrubbing, etc).

9. Atmospheric Monitoring-equipped with means of monitoring interior concentrations of oxygen, carbon monoxide, and carbon dioxide.

REASON FOR THE PETITION

A refuge chamber is a portable chamber that is intended to provide water, food, breathable air, and a seal to protect occupants from the outside hazardous environment for a finite period of time until employees can escape or be rescued. This type of emergency structure or equipment is used in underground mining and tunneling operations.

The existing standards require employers to provide a refuge chamber that is acceptable to the Division of Occupational Safety and Health (Division) if the tunnel is gassy or extra-hazardous, longer than 5,000 feet, and there's no alternate escape route. The standard does not provide a detailed explanation as to what is acceptable to the Division aside from the basic requirement to provide air supply, telephone, and means of isolating the chamber from tunnel atmosphere. For example, the standard is silent as to the quantity and quality of air supply.

The Division's Mining and Tunneling Unit evaluates the acceptability of a refuge chamber on a case by case basis. Prior to construction, the general contractor and/or the tunnel owner submit(s) a geotechnical report to Division, which contains information to characterize the tunnel. It includes information on the subsurface soil, rock, gas and water conditions The Division utilizes the report to classify the tunnel in one or combination of the following categories: non-gassy, potentially gassy, gassy and extra-hazardous. If a tunnel is classified as gassy or extra-hazardous, the inspector will make a professional judgment, based on his/her education, experience and information in the geotechnical report and decide on the specifications of a refuge chamber in that particular tunnel.

The Mining and Tunneling Unit evaluates potential and existing hazards by conducting a pre-job conference and re-occurring site visits. A site inspection is conducted every two months while the tunnel is being built. This is in addition to inspections triggered by complaint(s) and/or accident(s). The inspector has a duty to bring to the attention of the employer any new hazard discovered. With respect to rescue chambers, the inspector with the approval of the District

Manager can modify or add more requirements to the refuge chamber based on current site conditions.

For each tunnel that is classified as gassy and extra-hazardous, longer than 5,000 feet with no alternate escape route, the inspector and the employer has to answer these questions. If a catastrophe occurred and employees managed to gather in an area:

1. How structurally sound should that place of refuge be?
2. How long would it take to clear or create an escape route and allow the employees to leave or be rescued?
3. What would it take to sustain life for that period of time?

Given the same tunnel, the answers to these questions could vary depending on the inspector and the employer. Establishing minimum baseline answers to these questions would allow the inspector to use his negotiating capital in addressing other hazards. It would also give the contractor some predictability in planning for the job.

The frequency of the site visits and the duration of the project allow the inspector to build a rapport with the employer. Typically, an agreement regarding issues with a refuge chamber can be reached without a need for a variance or special order. But if necessary, the Division may issue a special order or the employer may submit a variance.

Below are Tunnel Safety Orders relevant to refuge chambers:

> T8 CCR 8425 (j). Operations of Gassy and Extra Hazardous Tunnels
> (j) A refuge chamber or alternate escape route shall be maintained within 5,000 feet of the face of a tunnel classified as gassy or extra-hazardous. Workers shall be provided with emergency rescue equipment and trained in its use. Refuge chambers shall be equipped with a compressed air supply, a telephone, and means of isolating the chamber from the tunnel atmosphere. The emergency equipment, air supply, and rescue chamber installation shall be acceptable to the Division.
>
> T8 CCR 8422. Tunnel Classifications.
> (b) The Division shall classify all tunnels or portions of tunnels into one of the following classifications:
> (1) Nongassy, which classification shall be applied to tunnels where there is little likelihood of encountering gas during the construction of the tunnel.
>
> (2) Potentially gassy, which classification shall be applied to tunnels where there is a possibility flammable gas or hydrocarbons will be encountered.
>
> (3) Gassy, which classification shall be applied to tunnels where it is likely gas will be encountered or if a concentration greater than 5 percent of the LEL of:

(A) Flammable gas has been detected not less than 12 inches (304.8 mm) from any surface in any open workings with normal ventilation.
(B) Flammable petroleum vapors that have been detected not less than 3 inches from any surface in any open workings with normal ventilation.

(4) Extra hazardous, which classification shall be applied to tunnels when the Division finds that there is a serious danger to the safety of employees and:
Flammable gas or petroleum vapor emanating from the strata has been ignited in the tunnel; or
(A) A concentration of 20 percent of the LEL of flammable gas has been detected not less than 12 inches (304.8 mm) from any surface in any open working with normal ventilation; or
(B) A concentration of 20 percent of LEL petroleum vapors has been detected not less than three inches from any surface in any open workings with normal ventilation.

FEDERAL STANDARDS

The Petitioner is requesting amendments to safety orders that correspond to the federal Occupational Safety Occupational Safety and Health Administration (OSHA) standards found in 29 CFR. However, among the regulatory agencies, Mining Safety Health Administration (MSHA) is the lead authority when it comes to refuge alternatives, largely due to recent changes in legislation and standards.

In 2006, there were 3 mine accidents that resulted in 19 fatalities in the mining industry (Sago Mine, Alma No. 1, and Darby No. 1). This gave the impetus for the enactment of The Mine Improvement and Emergency Response Act of 2006 (Miner Act). Section 13 of this act mandated that the National Institute of Occupational Safety and Health (NIOSH) conduct research concerning refuge alternatives. NIOSH defines refuge alternatives as different means of refuge such as: refuge chambers, which can be stationary or portable; in place shelters such as safe havens, safe rooms; and escape vehicles, etc.

As a result, on December 21, 2008 the final rule relating to 30 CFR Parts 7 and 75 required mine operators to include refuge alternatives as part of the Emergency Response Plan. Sections 7.504, 7.505, 7.506 of 30 CFR describe the criteria and MSHA approval process for refuge alternatives. These standards gave the private industry direction and specificity in designing and manufacturing refuge chambers.

Although there are differences in scale, depth, duration, and operations in a mine versus a tunnel, both operations have some similar potential hazards such as fire, explosion, cave-ins, and release of toxic gases and water. In addition, a mine by nature has a tunnel or a network of tunnels. It is reasonable to evaluate the petition to amend the Tunnel Safety Orders related to refuge chambers by giving careful consideration to the safety standards promulgated by MSHA. Conversely, the Board has to be mindful of the fact that these standards were written for underground mines; therefore they should only serve as guidance and should not be adopted wholesale. Some of the requirements may

be too stringent and others may be less protective or impractical for tunnel operations. MSHA and federal OSHA provisions related to refuge chambers include the following:

Mining Safety and Health Administration (MSHA)

Part 7 - Testing by Applicant or Third Party

- 30 CFR 7.504 Refuge alternatives and components; general requirements
  Among the requirements listed include but not limited to:
  1. Electrical parts
  2. Maximum temperature allowed inside the refuge alternative
  3. Communication
  4. Lighting
  5. Sanitation
  6. First aid supplies
  7. Tools and supplies for repairs
  8. Fire protection
  9. Container requirements

- 30 CFR 7.505 Structural components
  Requirements include:
  1. Space per person
  2. Storage space
  3. Air lock barrier or system able to maintain positive pressure
  4. Pressure strength requirements
  5. Flash fire ratings
  6. Material specifications
  7. Provisions for measuring outside air
  8. Inspection and testing requirements
  9. Set-up considerations

- 30 CFR 7.506 Breathable air components
  Specifications include:
  1. Means of delivering breathable air
  2. Breathable air duration of 96 hours
  3. Acceptable air quality
  4. Requirements on fan and compressors and safety devices
  5. Certification of the quality of air

Occupational Safety and Health Administration (OSHA)

- 29 CFR 1926.800 (b) Access and Egress
  (b)(1) The employer shall provide and maintain a safe means of access and egress to all work stations.
- 29 CFR 1926.800 (g) Emergency Provisions
  Subsection (g) does not mention the requirement to provide refuge chambers.
- 29 CFR 1926.800 (m) (12) Fire Prevention

> Any structure located underground or within 100 feet (30.48m) of an opening to the underground shall be constructed of material having a fire-resistance rating of at least one hour*.
>
> *Fire resistance in accordance with NFPA 251-1969

The Occupational Safety and Health Administration govern standards applicable to underground tunnel construction. 29 CFR 1926.800 applies to the construction of underground tunnels, shafts, chambers, and passageway. Federal standard requires a safe means of egress without explicitly requiring refuge chambers. Whether or not the Tunnel Safety Orders provide commensurate protection compared to the federal standard 29 CFR 1926.800 is unclear. Although federal standards do not explicitly require refuge chambers, they require all structures underground to be constructed of material with a fire resistance rating of one hour. Using fire resistance of a structure as criteria, commensurate safety depends on what the inspector accepts as suitable structural components for a refuge chamber. There may be variability among inspectors in assessing what the fire resistance of a refuge chamber should be. There are no written directives or baseline requirements for the structural components of a refuge chamber.

STAFF EVALUATION

The State of California acknowledges the relevance and importance of safe refuge or chambers in emergencies. It is noteworthy that the standards in the Tunnel Safety Orders and Mine Safety Orders, which predates the Miner Act 2006, explicitly mention the provision for refuge chambers or refuge stations. However, both sets safety orders do not define refuge stations or refuge chambers.

Existing standards need further clarification by establishing baseline requirements. This would provide clarity to the employers and State inspectors. Further discussion with industry, labor, subject matter experts, and safety professionals are needed to consider at least the following, as it applies to tunnels:

- Definition of a refuge chamber which should include reference to its intended use (refuge outby or refuge chamber or both)
- When is it needed (diameter, length, and classification of tunnels)?
- How should the criteria for refuge chamber or refuge station be different in tunnels vs mines?
- Structural design, life support requirements (food, water, first aid, sanitation)
- Acceptable breathable air criteria inside the refuge chamber
- Where should it be located and how should it be setup?
- How should it be incorporated in the emergency procedures?
- How should it be maintained?
- What are the training requirements?

Board staff has a concern about the operational viability and economic feasibility of the petitioner's request to require employers to provide refuge chambers in all tunnels without an alternate escape

route regardless of the classification of the tunnel. Further research and discussions are needed to determine if this is warranted and if so, under what parameters, for example diameter, length, depth, seismic location of the tunnels.

In response to the criteria listed by the Petitioner, 30 CFR 7.504, 7.505, and 7.506 detail the criteria and equipment approval process of MSHA. These sections may serve as a starting point for California to develop or update existing safety standards in the Mining Safety Orders and Tunnel Safety Orders. New standards are needed to clarify to the Division and industry stakeholders the minimum requirements for refuge chambers because the existing standard does not provide enough specificity.

Board staff notes that this petition may become relevant to the proposal to build state water tunnels as part of the Bay Delta Conservation Plan. According to an article from Sacramento Bee dated April 23, 2013, the proposal includes the construction of two tunnels, each approximately 40 feet in diameter and approximately 35 miles long. It states that the Delta is a productive natural gas region with gas wells. Therefore portions of the tunnels maybe classified as gassy or even extra-hazardous. If the project is approved, refuge chambers may be required.

DIVISION EVALUATION REPORT

The Board received the Division's report dated May 17, 2013. The Division recommends that an advisory committee be granted to the extent of being referred to an advisory committee.

The Division's report speaks of standards that require a minimum amount of air velocity to prevent a buildup of flammable gas and other fire prevention measures. A refuge chamber is meant to be a redundant safety measure, as a means of escape in case the air supply is compromised and an accident occurs. It also provides a means of escape against an earthquake or other types of emergencies that require temporary shelter.

Board staff agrees with the Division's evaluation and believes that codifying the minimum standards acceptable to the Division may increase circumstances in which a manufactured portable chamber would be required.

RECOMMENDATIONS

Board staff recommends that the petition be granted to the extent that an advisory committee be convened by the Division's Mining and Tunneling Unit. The Division at minimum should consider the MSHA refuge alternatives criteria in its deliberations regarding the petitioner's recommended criteria. The petitioner should be extended an invitation to be part of the advisory committee.